

**ASSESSING THE FEASIBILITY OF COMPOSTING FOOD WASTE**

**AT BALL STATE UNIVERSITY**

**A CREATIVE PROJECT**

**SUBMITTED TO THE GRADUATE SCHOOL**

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**BY**

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## **1.0 ABSTRACT**

CREATIVE PROJECT: Assessing the Feasibility of Composting Food Waste

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The reported study provides a comprehensive overview of relevant composting information for Ball State University (BSU) decision-makers to reference when establishing a food waste composting operation on the Muncie campus. Through analysis of common composting methods, examination of five collegiate programs currently composting food wastes and interviews with three key informants from BSU, recommendations are provided for the University's consideration. The experiences of other colleges and universities detailed in this study demonstrate the feasibility and potential rewards for implementing a composting operation using food waste. This study advocates the use of pre-consumer food waste as a primary feedstock in its composting operation. Early planning should include a focus on identifying stakeholders that will ensure the sustainability of the program. Through integrating the composting operation into the academic curriculum, more meaningful experiences for staff and students are possible. This study provides critical information for BSU to consider while continuing its mission of sustainability and positioning itself as a leader in higher education in the State of Indiana.

## **2.0 INTRODUCTION**

Accounting for approximately 21 percent of the total waste stream, food waste is now the single most common material deposited in landfills (EPA, 2014). According to the U.S. Environmental Protection Agency (EPA), the United States generates over 34 million tons of food waste each year. Of this total, 96 percent was sent to either a landfill or an incinerator.

Composting can be an effective tool in redirecting food waste. By composting of food waste, society enjoys environmental and economic benefits. There is a reduction of methane, a powerful greenhouse gas that is produced from decomposing food. Composting creates a valuable cost-savings soil amendment while at the same time improving sanitation. Lower disposal costs are also a potential benefit of composting, as less tipping (disposal) is incurred.

### **2.1 The University Setting**

The combined undergraduate and graduate on-campus student enrollment at Ball State University for the 2013-2014 school year was 17,225. According to Jon Lewis, Director of Dining Services, the department operates 14 dining operations across campus including catering and sports operations. With the intention to maintain sanitary sewers, the Muncie Sanitary District restricts the department from disposing food waste into a garbage disposal. Therefore, food waste generated from BSU dining operations is currently placed with other solid wastes for eventual landfill disposal.

BSU has shown a commitment to environmental stewardship through numerous initiatives. As an initial signatory to the American College and University Presidents Climate Commitment, the University has set the audacious goal of achieving climate neutrality. Climate neutrality is attained when the University removes as many greenhouse gas emissions from the atmosphere as it emits. The University has committed substantial financial resources toward this

goal through construction of the largest ground source, closed-loop geothermal energy system in the country. According to the University, once fully operational, the geothermal energy-system will cut its campus carbon footprint in half.

The University currently operates recycling and composting programs. The recycling programs “divert 20 percent of waste (i.e., paper, cardboard, newspapers, pop cans, glass, and some plastics) each year from landfills” (Ball State University, 2015). The composting program managed by Ball State Landscaping Services composts approximately 9,000 cubic yards of material each year (Ball State University, 2015). The five major components of the compost are leaves, grass clippings, brush pallets/wood waste and wood chips. In order for the University to remain consistent with its commitment to sustainability, it needs to identify an alternative method of disposing its food wastes. The investigation of a comprehensive composting program provides the University with a viable option in addressing this need.

Methods employed during the study included collecting and weighing pre-consumer food waste from Woodworth Commons to better understand the quantity of food waste that is currently being sent to landfill from Ball State University’s (BSU) Dining Services. Woodworth Commons is the recently remodeled food court located on the first floor of Woodworth Complex that is responsible for distributing the largest volume of food on campus. Woodworth Complex is the only all-women’s housing unit on the BSU campus.

The initial project plan was to collect and weigh food waste from breakfast, lunch and dinner sessions on randomly selected days in a given month. With food preparation not aligning with traditional breakfast, lunch and dinner schedules, however, weights were collected any time that dining staff prepared meals for a given day. With the cooperation of the Woodworth Commons dining staff, data was collected daily from 02/10/2014 to 03/06/2014.

Methods employed for this study also include the use of key informant interviews. A key informant interview is a loosely structured conversation with individuals who have a particular knowledge on a topic that may not be available elsewhere. In order to better gauge composting options on the BSU Muncie campus, it is imperative to solicit input from individuals possessing institutional insight. The following individuals were interviewed: Jon Lewis, Director of Campus Dining Services; Amy Grasso, Woodworth Complex Unit Manager; and Mike Planton, Associate Director for Landscape and Environmental Management.

Upon completion of data collection at Woodworth Commons and prior to the key informant interviews, research was conducted to identify other colleges and universities that currently have viable composting operations that include food waste from their respective campus activities. Conclusions drawn from the data collection, background research and key informant interviews were used to formulate recommendations for the University to consider moving forward with a campus food waste composting operation.



### **3.0 WOODWORTH COMMONS**

Woodworth Commons, the food court of the Woodworth Complex, was selected as the dining center to collect data in this study. This decision was made during an initial meeting on 11/27/2013 between myself; Jon Lewis, Director of Dining Services; and Mike Planton, Associate Director for Landscape and Environmental Management. Mr. Lewis suggested Woodworth Commons to be the focus of the study due to the strong leadership provided by Ms. Amy Grasso, Woodworth Complex Unit Manager. During a subsequent meeting on 02/06/2014 between myself, Mr. Lewis and Ms. Grasso, it was decided that collection of data would occur over a one-month time-frame in order to obtain a representative sample for the quantity of food waste leaving the kitchen area. Prior to this meeting, sample collection at random dates in a given month was considered.

It was decided that the study focus solely on pre-consumer food waste due to the logistical requirements/constraints associated with collecting data of post-consumer food waste. It was disclosed that the food preparation schedule at Woodworth Commons does not follow a traditional breakfast, lunch and dinner schedule. Rather, food preparation typically occurs early in the day that it is being served. As a result, the study focused on collecting weights of food waste whenever food preparation occurred in a given day. For 25 days, data was collected at Woodworth Commons.

The weighing of food waste began on Monday February 10, 2014 and ended on Thursday March 6, 2014. The end date fell in the fourth and final week of the study, the last full day before students left campus for Spring Break.

Over the course of 25 consecutive days, a total of 1,930 lbs. of pre-consumer food waste was collected and weighed. The day with the lowest weight was Tuesday 02/22/2014 at 32 lbs.

The day with the highest weight was Friday 02/14/2014 at 120 lbs. The average daily weight was 77.21 lbs. In one month, in one dining hall, only utilizing pre-consumer food waste, nearly one ton of organic waste was discarded to the traditional waste stream. When extrapolating over a full academic year across the entire campus, it becomes evident that BSU has a tremendous opportunity to make a meaningful difference and lead the way amongst Academia in the state of Indiana in managing its waste stream more sustainably. The figure below illustrates the daily totals of food waste collected at Woodworth Commons. See Appendix A for a more detailed list of weight of food waste collected daily.

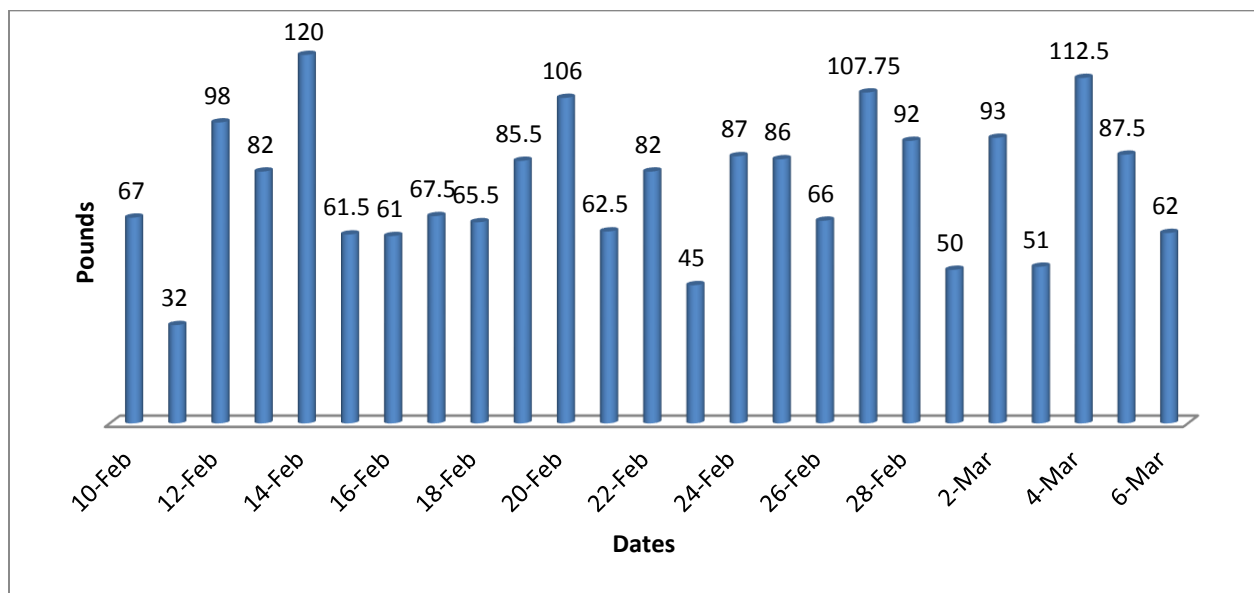


Figure 1. Pre-consumer food waste collected from Woodworth Commons.

## **4.0 BACKGROUND**

### **4.1 The Composting Process**

The EPA defines compost as “organic material that can be used as a soil amendment or as a medium to grow plants” (EPA, 2015). Compost is produced by mixing organic wastes (e.g., food wastes, yard trimmings, livestock manures) in appropriate ratios with bulking agents (e.g., wood chips) to create the appropriate carbon to nitrogen ratio (ESRC, 2014).

A key variable for successful composting involves creating the proper particle size. Increasing particle surface area through grinding, chipping and/or shredding allows for microorganisms, oxygen and water to move freely and ultimately create a more homogeneous final product. However, if particle size is too small, air flow will be prevented, with possible generation of anaerobic conditions.

Moisture content must be attended to, as indigenous microorganisms require it to gain access to nutrients in the organic material. It is recommended to keep moisture content in the pile below 65% to avoid problems with runoff (Canada, 2014). Oxygen flow is another important variable for successful composting. This issue is addressed by either turning the pile or aerating with forced airflow from pipes. Too little oxygen will result in anaerobic conditions which result in the generation of undesirable by-products such as methane and odor. In contrast, too much oxygen will dry out the pile resulting in a slower composting process. Airflow helps control temperature in the piles, which is another important variable. Temperature control is necessary as microorganisms require a certain range of temperature for optimal activity (ESRC, 2014). Through focusing on the above five variables, a successful composting process is possible.

In the composting process, a succession of microbial communities brings the process to completion. Initiating the process are the mesophilic (i.e., middle-temperature range) bacteria that break down soluble, readily degradable compounds (e.g., sugars, starches). After several

days to weeks thermophilic bacteria replace the mesophilic populations; this occurs when temperatures in the compost pile exceed 104° F. The thermophiles break down proteins, fats, cellulose and hemicellulose. The higher temperatures associated with composting destroys pathogens and weed seeds. By controlling temperature, numbers of pathogenic species such as *Escherichia coli* and *Salmonella spp.* are reduced to acceptable levels (ESRC, 2014). After approximately 30 days the bacteria transition to a fungi-dominated community. Fungi and actinomycetes produce the finished product through the curing stage by acting upon the more resistant compounds such as lignin and cellulose, i.e., the ‘woody’ materials in the finished product (ESRC, 2014).

## **4.2 Environmental and Health Concerns Regarding Composting**

When operating a composting operation, proper planning can mitigate potential issues with runoff/leachate, vectors, odors, pathogens and bioaerosols.

### **4.2.1 Leachate Management**

The On-Farm Composting Handbook (Northeast Regional Agricultural Engineering Service, NRAES) defines leachate as “the liquid that results when water comes in contact with a solid and extracts material, either dissolved or suspended, from the solid.” In operating a composting operation, leachate management must be addressed to avoid groundwater and/or surface water contamination. The type of composting operation chosen will dictate the degree in which leachate will need to be managed. Systems exposed to weather, i.e., those using uncovered windrows or static pile aerated systems, require a greater emphasis on leachate management. A windrow is defined as rows of long piles of organic wastes (EPA, 2015). Closed systems, such as in-vessel or vermicomposting operations often have built-in controls to manage the lesser volume of leachate generated from the compost.

Leachate management can be viewed in two phases, i.e., control/collection and use/treatment. Options for control/collection include grading the composting site appropriately, along with the use of water collection systems. The placement of the pile on an impervious surface facilitates leachate collection, and the use of an onsite collection pond is an additional option for leachate management. Keeping moisture content in the pile below the recommended level of 65% (Canada, 2014) will assist in limiting leachate production. In addition, maintaining a proper carbon to nitrogen ratio in the pile will help reduce the loss of nitrogen into the leachate (Canada, 2014).

Leachate treatment often involves directing leachate to a sanitary sewer system where it can be treated by the local wastewater treatment plant. Leachate can also be an asset; since leachate contains valuable plant nutrients and organic matter, it is often applied directly to soil as a fertilizer, or compost tea (Canada, 2014). Leachate can also be added to windrows to achieve desired moisture content.

#### **4.2.2 Vectors**

According to the California Integrated Waste Management Board (Crohn, 2015), a vector is “any insect or other arthropod, rodent, or other animal capable of transmitting the causative agents of human disease, or disrupting the normal enjoyment of life by adversely affecting the public health and well-being.” Common vectors associated with composting operations include flies, mosquitoes, birds, rodents and larger scavenging mammals (California, 2014). Besides potentially posing a hazard to human health and safety, vectors can adversely affect the aesthetic impact of the compost site and surrounding area. The sustainability of a composting operation can be directly tied to how well vectors are controlled.

Signs of vectors at a site include animal tracks, animal droppings, urine odor, gnaw marks, nests and borrows, visual sightings, and damage to windrows, site structures or equipment (California, 2014). Different control strategies may be required for different composting operations as certain vectors may be more common in different areas. A good approach to limit the attraction of vectors is to promptly mix organic wastes (e.g., food wastes) with carbon stocks into windrows (USDA, 2008). Eliminating standing water will deny a source of water for vectors and also breeding grounds for mosquitoes. The use of decoys and birds of prey can reduce bird problems. Site fencing can assist in preventing access by larger scavenging mammals.

#### **4.2.3 Odor**

Decomposition, i.e., the biological and chemical process through which compounds are broken down to smaller components, is the essence of composting. The decomposition process often creates odor, a complex collection of volatile gases. The inability to appropriately manage odor at a composting facility is the single biggest reason for “adverse publicity, regulatory pressures and facility closures in the organics recycling industry” (Coker, 2012). Eliminating odor is also a critical step in reducing vectors.

Odors at a composting operation occur when optimal aerobic conditions change to a low-oxygen, partially anaerobic state. The resulting odors include a range of compounds, including noxious sulfur compounds, volatile fatty acids, aromatic compounds and amines (Ohio EPA, 1999). Ammonia is often the most prevalent odor-producing compound generated in a partially anaerobic pile. Maintaining aerobic conditions is the best approach to mitigating odor. Maintaining aerobic conditions is best achieved by controlling nutrient balance, temperature, moisture content and aeration. Too much nitrogen in the compost mix can cause increased

microbial growth, which can create anaerobic conditions by consuming oxygen too rapidly. Temperatures exceeding 140° F may promote conditions which support anaerobic activity (Ohio EPA, 1999); therefore, keeping temperatures below this threshold allows for aerobic microorganisms to thrive. Maintaining desired moisture content allows for proper aeration, subsequently creating aerobic conditions.

Operational practices that can assist in reducing odors associated with anaerobic conditions include mixing food wastes with coarse, dry bulking agents, actively turning windrows, providing forced aeration, sizing windrows uniformly and placing a biofilter layer over the windrows (Ohio EPA, 1999). A biofilter layer is simply a thin layer, at least six inches thick, of either finished compost or bulking agent on the exterior of the pile that assists in mitigating odor. In between turnings, the biofilter layer can metabolize odor-producing compounds. Commercial products such as enzymatic catalysts are also available to control odor and are sprayed or applied directly to the surface of the windrows. Oxidizing chemicals such as hydrogen peroxide and potassium permanganate can chemically oxidize anaerobic odor-producing compounds. No matter what strategy is employed, it is important to remember that odor control is an ongoing process. Understanding the circumstances that lead to anaerobic conditions is the best way of mitigating odor.

#### **4.2.4 Pathogens**

Pathogens are defined as organisms that can cause disease within another host organism. In controlling pathogens, compost operations must be managed to keep employees and the surrounding areas safe. Pathogens of relevance to composting include various species of bacteria, protozoa, viruses, fungi and helminthes (parasitic worms) (Crohn, 2014).

During composting operations, pile temperatures during the thermophilic phase are sufficient to kill most pathogens - temperatures can attain 150° F during this period. Compost within an in-vessel or static pile system must reach 131° F continuously over three days to destroy pathogens. Turned windrows must be kept at 131° F for 15 days, during which the windrows must be turned at least five times (Crohn, 2014). During the composting process preferred microbial communities flourish while pathogenic microbes are reduced. The curing process, that can take anywhere from six weeks to six months, provides additional time and opportunity for preferred microbes to consume pathogens and any odoriferous or phytotoxic compounds.

#### **4.2.5 Bioaerosols**

An additional concern regarding pathogens during composting regards management of bioaerosols. The definition of a bioaerosol includes “all particles having a biological source that are in suspension in the air and includes microorganisms as well as biomolecules” (Wery, 2014). Due to the large amount of physical mixing and agitation taking place at a composting site, bioaerosols are ubiquitous and may pose a hazard to site workers and surrounding areas. The actinomycetes *Aspergillus fumigatus* and *Penicillium sp.* are seen as the dominant culturable microorganisms in composting bioaerosols (Wery, 2014). The hazard of these particulates relates to inhalation into the lungs.

Air quality management must be addressed at a composting site. Air quality for indoor systems do not have the benefit of winds to dissipate bioaerosols. Indoor systems, as a result, must employ an internal air filter. In contrast, outdoor composting systems must rely on personal protection, facility design and operational activities to maintain safe conditions (Epstein, 1996). Personal protection includes education and periodic training on health and safety issues that are



apropos to a composting facility. Personal protection also includes the use of personal protection equipment such as ear plugs, eye wear, hard hats and suitable respirators.

Regarding facility design, areas where materials are agitated or turned should be kept separate from high-traffic worker paths. In regards to operational practices, keeping the facility as clean as possible will reduce issues with air quality. The use of water to spray down dusty areas can also assist in maintaining acceptable air quality.

### **4.3 Composting Methods**

Rethinking waste management practices is occurring on campuses throughout the United States as institutional leaders seek more sustainable ways of dealing with organic wastes. An approach proving to be practical involves composting of food waste from campus activities, which ultimately redirects food waste away from landfill disposal. Choosing the composting method that best fits an institution's needs, along with adopting practices that optimally support the operation, are critical in ensuring that a program is sustainable. Four different types of composting methods are considered for large volumes of food waste typically associated with universities: vermicomposting, turned windrows, forced aerated static pile (ASP) and in-vessel systems.

#### **4.3.1 Vermicomposting**

Vermicomposting uses red worms, *Eisenia fetida*, to break down organic matter. The worms feed on both food solids and microorganisms that grow on the surface of the waste, then excrete smaller-size particles termed 'worm castings' (Gannett Fleming, 2002). It is estimated that one pound of worms, approximately 800-1,000 in number, can consume up to one-half pound of organic material per day (EPA, 2014). On average, the vermicomposting process produces castings that can be harvested in approximately three to four months. A minimal amount of

equipment and material is necessary with vermicomposting operations: worms, organic matter (e.g., food scraps), bulking agent/bedding (e.g., shredded newspaper, cardboard, wood chips) and a structure/bin to contain the mixture of materials.

The preferred food scraps to use in a vermicomposting operation includes breads, cereals, coffee grounds, fruits, grains, pasta, tea bags and vegetables. Food scraps to avoid include dairy products, fats, meat and oils (Gannett Fleming, 2002). The latter should be avoided to reduce vectors (e.g., rodents). Due to the importance of microbial growth to a successful vermicomposting operation, it is imperative to optimize the carbon to nitrogen (C:N) ratio. Carbon provides the energy for microbial growth, while nitrogen is required for building cellular biomass (Gannett Fleming, 2002). By weight, the C:N ratio should be approx. 30 to 1. When preparing mix, a 3:1 ratio by volume or 4:1 ratio by weight of food waste to the chosen bulking agent is recommended (Gannett Fleming, 2002).

The optimal temperature range for vermicomposting is from 55° F to 77° F (EPA, 2014). The preferred location is indoors, as extreme temperatures and direct sunlight may inhibit the process. The pH, ammonia and salt concentrations of the mix are significant variables to regulate. Avoiding animal-related products will help to prevent ammonia buildup, as ammonia is typically released from degradation of animal products (Gannett Fleming, 2002). Regularly wetting the system will assist with flushing salts and ammonia out of the system. Keeping the pH range within 5 - 9 will support the optimal environment; avoiding acidic food wastes such as citrus will assist in accomplishing this goal.

Vermicomposting typically involves the following steps: collection of organic waste and bulking agent, shredding, mixing, pre-composting, loading, harvesting, storage and use (Gannett Fleming, 2002). Once collected, the materials must be shredded and then mixed in the

appropriate ratios. Preferably, the mix will be provided time to pre-compost or cool outside of the chosen bin structure. The mix is subsequently applied to the top of the bin in six-inch layers. The worms then begin breaking down the mix. At the bottom of the bin structure, a mixture of vermicompost and worm castings fall through a screen into a container. The collected mixture of vermicompost and castings is then stored in a covered area to air-dry. Once dry, it is ready to be applied as a soil amendment.

A flow-through vermicompost system is shown in Fig. 2. The basic premise of such a system is to add layers of mix, preferably no more than six inches at time, to avoid compaction and anaerobic conditions, and then allow the worms to process successively added layers. Keeping the system lidded prevents loss of moisture.

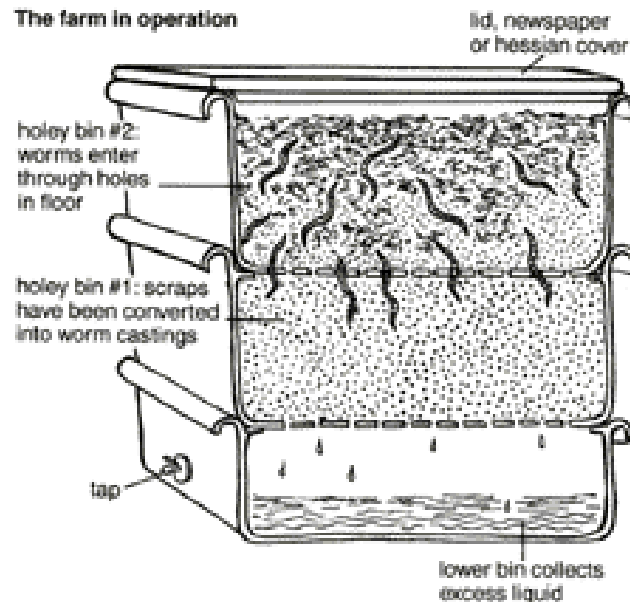


Figure 2. Flow-through vermicomposting system. <http://www.countryfarm-lifestyles.com/Worm-Farming.html>

The costs associated with a vermicomposting operation are primarily initial costs, i.e., in purchasing the materials to build the bins or obtaining a finished commercial system. The scale at which the vermicomposting operation is expected to operate will play a role in the number of bin structures built or purchased. Whether the bins are housed in a new, separate facility or in an existing storage area (e.g., basement) will also have an impact on costs. In considering the potential savings from reduced waste disposal costs, vermicomposting appears to be a viable alternative.

#### **4.3.2 Turned Windrows**

In the turned windrow process, the mixture of organic waste and bulking agent is arranged into extended rows of piles. The windrows are turned periodically, providing the mixture the necessary oxygen for microbial activity. Turning can be carried out manually or, more commonly, by mechanical means (e.g., backhoe, front-loader).

The preferred food waste to use in a turned windrow composting operation is the same as was listed for vermicomposting: breads, cereals, coffee grounds, fruits, grains, pasta, tea bags and vegetables. Food scraps to avoid includes dairy products, fats, meat and oils (Gannett Fleming, 2002). Initially, the C:N ratio by weight should be approx. 30 to 1. When preparing the mix, a 3:1 ratio by volume or 4:1 ratio by weight of food waste to bulking agent is recommended (Gannett Fleming, 2002).

A turned windrows operation typically involves the following steps: collection of organic wastes, shredding, mixing, windrow building, active phase of composting with periodic turning of the piles and required monitoring, curing, and, ultimately, storage and use.

Once the raw feedstock is collected, the materials are shredded and mixed in the ratios previously mentioned. Once mixed, windrows are constructed. The EPA (EPA, 2014) suggests an ideal height between 4 and 8 feet and an ideal width between 14 and 16 feet.

The active phase of composting using turned windrows involves a succession of mesophilic and thermophilic stages. The mesophilic stage begins immediately after pile formation, where pile temperatures rapidly increase. Within the first 24-72 hours, temperatures reach 130° F. Pile temperatures during the thermophilic stage are subsequently maintained for several weeks.

Oxygen is consumed by microorganisms, thus requiring the pile to be mechanically turned to reintroduce oxygen. Monitoring moisture content and temperature of the windrows ensues throughout the active phase. When checking pile temperatures, it is important to probe several different locations so that a representative temperature profile is attained.

Once pile temperatures stabilize at about 100° F and the rate of oxygen consumption in the pile reaches a point where it no longer needs to be turned, the pile is ready for curing. The piles are transferred to a curing area where it will stabilize. As with all composting methods, the initial mix and chosen management strategies will dictate the time needed for the compost to cure. The process is considered complete once the feedstocks are no longer actively decomposing and are chemically and biologically stable (Cooperband, 2002). When the temperature at the center of the pile reaches ambient levels and oxygen concentrations are at 10-15% for “several days,” the composting is considered “stable or finished” (Cooperband, 2002).

An advantage of the windrow method is its ability to handle large volumes of wastes. It can also function outdoors in cold climates, an important factor to consider for a possible scenario in Muncie, Indiana. During hot and dry weather, the piles can be covered to prevent

moisture loss. Disadvantages of the method include the need to turn the piles, and the large parcels of land that are necessary. A turned windrow system is the most commonly used method to compost organic wastes (ESRC, 2014). While it is often referred to as the simplest, it is also the most labor-intensive approach. Figure 3 show windrows being turned with a tractor and attachment, and also with a front-end loader.



<http://www.martinsfarmcompost.com>



<http://jcbcea.com.au/media/release/waste-not-want-not-200t-of-organic-materials-reclaimed-every-week>

Figure 3. Windrows being turned.

#### **4.3.3 Forced Aerated Static Pile**

Forced aerated static pile (ASP) composting can be conducted indoors or outdoors. A network of perforated pipes delivers air into a constructed pile containing food waste and a bulking agent. Most often single piles are used, though extended piles (i.e., windrows) can also be constructed. The height of the piles or windrows should initially be approximately 5-8 feet (UN, 2003).

Individual piles often contain a single large batch of materials (UN, 2003). When feedstock for composting are only available at intervals, individual piles are practical.

The preferred food waste to use in a forced ASP system is the same as that listed for vermicomposting and turned windrow operations. Likewise, the food wastes to avoid are the same (Gannett Fleming, 2002). By weight, the C:N ratio of the starting material should be approx. 30 to 1. When preparing the pile, a 3:1 ratio by volume or 4:1 ratio by weight of food waste to bulking agent is recommended (Gannett Fleming, 2002).

Organic wastes are added to a dry, coarse bulking agent. Avoiding animal by-products and grease is recommended as they are more difficult to break down, especially in a non-turned composting process. Mixing can be accomplished manually, though the use of a mechanical mixer will likely produce a more homogenous blend. It is important to thoroughly mix the feedstocks initially and create an appropriate shape when building the pile as it will not be turned again. By forcing air through the pile, the mass is more likely to dry out; therefore, it will be necessary to add water to maintain appropriate moisture levels for microbial populations. With a forced ASP system, there are both high and low-technology options, depending on budget.

The mixture is applied over a porous base material (e.g., wood chips, chopped straw). Perforated pipes are situated within this porous base. Some researchers recommend the orientation of pipe openings downward to reduce plugging and to also allow condensate to drain, while others suggest placing the openings so that they face upward (UN, 2003). The pipe is attached to a blower that can blow or suck air through the pile. When using positive air pressure, i.e., blowing air through the pile, exhaust exits the compost pile over its entire surface. With negative air pressure, i.e., sucking air through the pile, air flow is reduced for the same rate of air flow due to the necessary presence of a fixed biofilter. Consequently, positive aeration provides

better air flow than negative, though the use of negative pressure allows for greater odor control. A layer of finished compost is often used as a cover to insulate the pile, retain moisture, limit vectors (e.g., flies) and filter ammonia odors. Construction of the piping should be carried out with mobility in mind; transferring the compost pile to the curing area is more easily accomplished when the piping can be moved out of the way. A forced ASP system is shown in Fig. 4.

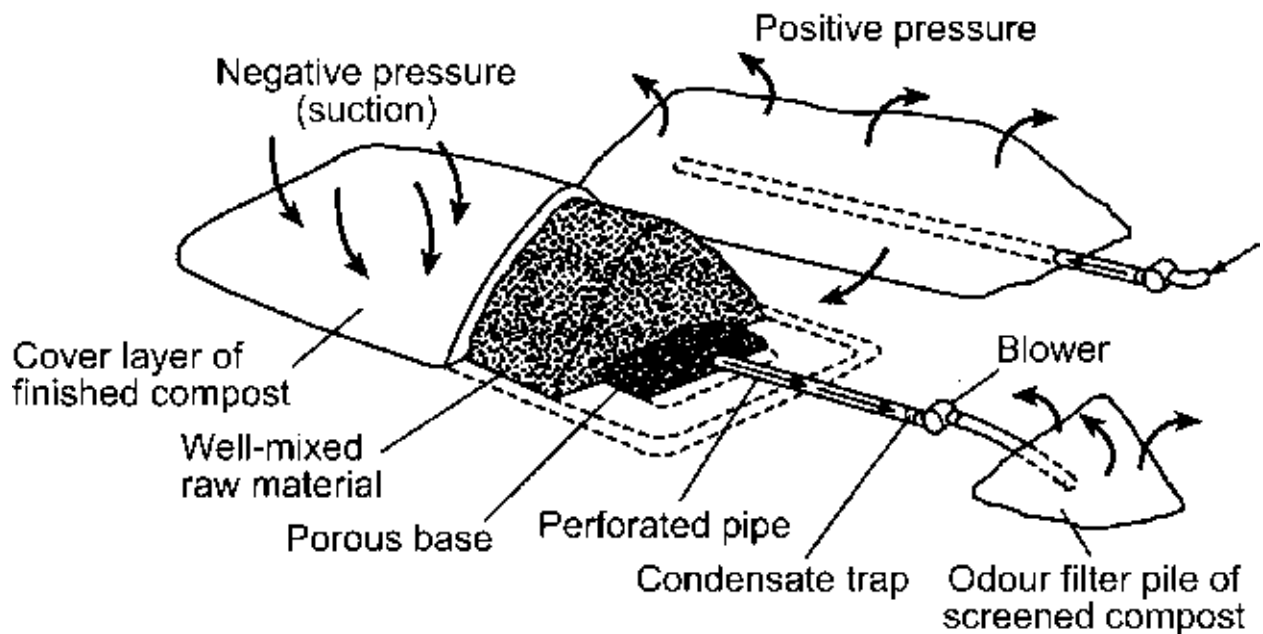


Figure 4. Forced ASP system. <http://www.fao.org/docrep/007/y5104e/y5104e07.htm>

The mixture rests on the perforated pipes for approximately 21-28 days (Green Mountain, 2013). The mixture is subsequently taken to a curing area for 30 to 180 days depending on the desired end-use. Testing the finished compost for pathogen removal and chemical composition will



ensure the most appropriate application of final product. At about the same time, non-composted wood chips are screened and separated for reuse in the next batch. The forced ASP process can produce compost relatively quickly, i.e., within 3 to 6 months (EPA, 2014).

A forced ASP system enclosed in a building makes climate a moot issue; however, a forced ASP system operating outdoors in a city with freezing winters make keeping piles at optimal temperatures a challenge. Covering the piles with an impermeable material assists in trapping internal heat. Maintaining oxygen levels above 13% is ideal for this composting method (Green Mountain, 2013). Regulating air flow controls oxygen levels, moisture levels and subsequently temperatures.

An ASP system can be more costly than a turned windrow system or vermicomposting operation as it requires equipment such as blowers, pipes and fans. A computerized monitoring system can control the rate and schedule the delivery of air to the composting mass. It may be necessary to tailor the timer cycle, pile size, and blower intensity to suit the compost mixture and specific site conditions. The use of meters and manual monitoring techniques serve to keep initial costs down; however, this technique may require additional monitoring.

An advantage with aerated static piles is that less space is needed, as large piles are used rather than smaller individual rows. There is also the enhanced ability to maintain proper moisture and oxygen levels by controlling air flow. This allows microbial populations to operate at peak efficiency, which is more effective at reducing pathogens (Green Mountain, 2013).

#### **4.3.4 In-vessel Compost Systems**

An in-vessel system involves feeding the mixture of organic materials and bulking agent into a drum, silo, concrete-lined trench, or comparable equipment for microbial action. Types and complexities of in-vessel designs vary, ranging from those requiring manual physical turning, to

elaborate powered mechanisms to move the material through a compartment. System temperature, moisture and aeration can be closely controlled, which is usually the reason for choosing such a design, as it allows greater control over associated nuisances (e.g., odors).

The preferred food wastes to use in an in-vessel system are the same as listed for vermicomposting, turned windrow and forced ASP operations. By weight, the starting C:N ratio should be 30 to 1. When preparing the mix, a 3:1 ratio by volume or 4:1 ratio by weight of food waste to the bulking agent is recommended (Gannett Fleming, 2002).

An in-vessel system typically involves the same steps as discussed for the other methods, i.e., collection of organic wastes and bulking agent, shredding, mixing, loading into the vessel, an active phase with mechanical agitation, curing, storage and use.

While they vary in size, an advantage of in-vessel composting is the ability to compost in a relatively small, enclosed space. The systems are also capable of composting large volumes of waste in any climate, ultimately producing compost relatively quickly. The disadvantage is that these machines are more likely to require technical assistance to operate optimally, and can be expensive (EPA, 2014). The in-vessel system that is currently being operated at Ohio University is shown in Fig. 5.

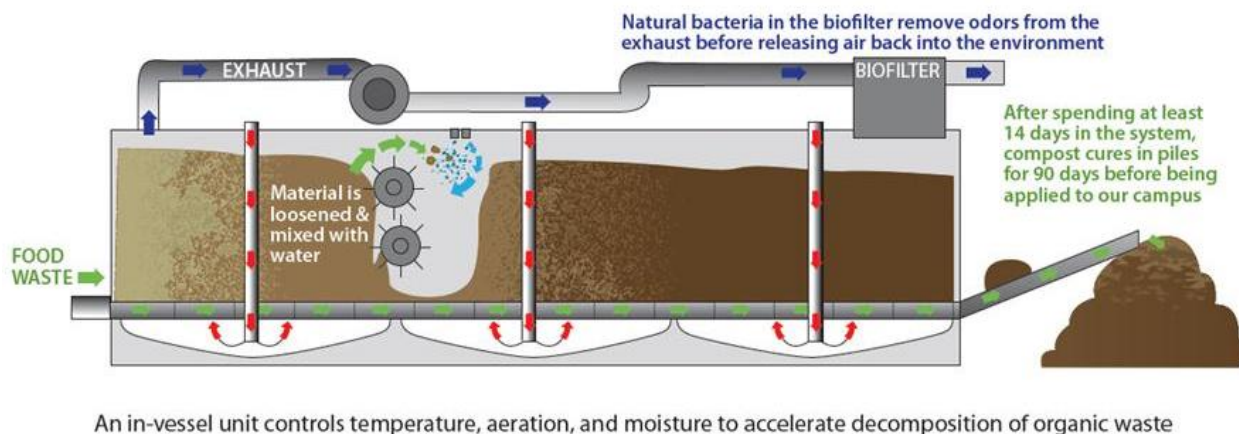


Figure 5. Ohio University In-Vessel System.

<http://www.ohio.edu/sustainability/programs/compost.cfm>

## 5.0 CASE STUDIES

The composting programs of Bates College (Lewiston, Maine), Ithaca College (Ithaca, New York), Clemson University (Clemson, South Carolina), University of Maine (Orono), and Lafayette College (Easton, Pennsylvania) are examined in some detail in the subsequent pages. A background of each school is provided for context, along with specifics of their respective composting programs.

### 5.1 Clemson University – Clemson, South Carolina

Located in rural South Carolina, Clemson is a public university serving approximately 21,000 students. Under the leadership of President James Baker, the University is proving to be at the forefront of sustainability. A primary goal of the University has been to make itself “a model of

affordable, fiscally responsible, environmental sustainability for public institutions of higher education” (Clemson, 2014). Clemson is a signatory to the American College and University President’s Climate Commitment. Clemson has also been an active participant in the South Carolina Sustainable Universities Initiative (SUI). Clemson has put forth the audacious goal of being zero waste and carbon neutral by 2030. A green focus can be seen across both its operations and curriculum.

In 2009 the President’s Commission on Sustainability (PCS) was established to provide the University the direction to achieve the aforementioned goals. In the subsequent year, the PCS released the University’s first comprehensive Sustainability Plan. Collaboration involves the student body, faculty, staff and the local community. The PCS meetings are open to all, occurring once per month. The PCS aims to accomplish the University’s goals through “integrating education, research, and public service with the social, economic, and environmental infrastructure” (Clemson, 2014).

Efforts to manage food waste at Clemson via composting can be traced back to a project in 2003 from Dr. Tom McInnis’s Senior Seminar in Biological Sciences. This project aimed to use vermicomposting as the means to manage campus food waste. The group received support from the South Carolina Sustainable Universities Initiative and the Clemson University Environmental Committee. The Department of Health and Environmental Control loaned the University a vermicomposter for the initial project. The group also received funding for the worms, a pH meter, a leaf shredder, a soil thermometer and topsoil from a SUI mini-grant. In an effort to advocate the use of vermicomposting as a means to more sustainably managing waste, the group participated in Clemson University Earth Day, and an event at a Clemson elementary school with over 1,000 students, giving two workshops.

Following the initial vermicomposting project, Clemson Recycling Services decided to address food waste on a much larger scale for the campus. In 2010 the department purchased an in-vessel composter with assistance from a SCDHEC research grant.

The University composts pre- and post-consumer food wastes from all three resident dining halls on campus. The composting process begins as organic items (e.g., food, napkins) are sorted from returned trays and placed in a pulper where they are then chopped to the preferred consistency and placed into bins for daily pick-up. At the loading docks, workers transfer bins containing both pre- and post-consumer food waste to be transported to the Cherry Crossing Research Facility. Once at the facility, the food waste is combined with wood chips and landscape grindings, and then placed into the in-vessel composting system. After four days in the in-vessel system (where pathogens are killed), the mixture is stockpiled in the curing area where it is turned daily for over one month. The finished product is then provided to the student-driven Organic Farm and the Botanical Gardens.

Challenges confronted during implementation of the Clemson composting program include high moisture content in the food, and various mechanical issues. To confront those challenges, additional staff were brought in to maintain the operation. As another example of the academic curriculum playing a vital role in sustainability of campus operations, a Creative Inquiry class was established in 2011 to examine practical composting issues.

A recent suggestion to improve composting at Clemson arose from a 2014 Creative Inquiry class. Students are looking at three projects: (1) A vermicomposting demonstration system to assess the potential for at-scale implementation; (2) Data collection on the use of a food-dehydrator on loan from Integrated Waste Solutions to determine whether it may be beneficial for use in the existing operation; and (3) Production of two videos to advertise the

program and educate regarding the composting system. The first video is to show the perspective of those involved in daily operations of the composting program. The second video will focus to the journey from plate to finished product.

The University is also looking at other projects, including a ‘Black Soldier Fly (BSF) Larvae Composting System, also initiated in a Creative Inquiry class. This pilot aims to convert food and farm waste to usable products, i.e., compost, animal feed and oil for biodiesel production. Waste and cull vegetables from farm production are placed into a digester where BSF larvae digest and convert the waste. Oil for biodiesel can be extracted from drying and pressing the BSF pupa. The remaining material is used as chicken feed, fish feed and fertilizer.

Beginning with vermicomposting efforts in 2003, Clemson has sought an alternative to landfill deposition of food wastes from campus-related activities. Since the inception of the composting program over 100,000 lbs. of food waste has been diverted from landfills (Clemson, 2014). Clemson is a model for other universities in terms of sustainable waste management. Their successes can be traced to leadership and community collaboration.

## **5.2 Bates College - Lewiston, Maine**

Located in Lewiston Maine, Bates College is a small private liberal arts school with approximately 2,000 students and over 200 faculty members. The school is a signatory to the American College and University President’s Climate Commitment (ACUPCC). While it has recently garnered attention for a focus on environmental stewardship, its dining program has been working toward sustainability for almost two decades (Hobart Center, 2014). Bates was the first food-service operation in higher education to join the Green Restaurant Association (GRA).

It recently was awarded a three-star rating from the GRA, an honor shared with only five other institutions (Hubley, 2013).

The college operates one main dining hall with an auxiliary site for lunch. In 1994, Bates College began implementing a food program focused on reducing wastes and costs, and also to use crops grown by local farmers. The inspiration generated by the program resulted in an increase in composting which was later expanded into a management system. The management system's goals embraced: (1) reducing the amount of waste sent to the city's landfill; (2) reducing costs associated with food waste; and (3) increasing recycling (EPA, 2007).

The school composting operation involves pre-consumer food waste only. Prior to program initiation, food waste was collected in a bin system that eventually was discharged to the sewer system after being processed in a garbage disposal. The garbage disposal ran an average of ten hours per day with an approximate usage of 3,300 gallons of water. Each week, an estimated 4,000 lbs. of food was being processed in the garbage disposal. This waste was believed to be the primary cause of increased biological oxygen demand (BOD) in local waterways (EPA, 2007).

In 2001, the college installed a 4-inch slotted pan strainer at the sinks to collect food, rather than sending it to the garbage disposal, ultimately reducing the quantity of organic matter being sent to the sewer. The College also began educating its dining staff, faculty and student body regarding waste management and environmental responsibility. The following steps were taken by the college: (1) trained staff are to provide specific-sized meal portions rather than allowing students to self-serve, ultimately reducing food waste; (2) communications from Dining Services were to increase, with the collaboration of faculty and student groups; (3) three bins were available for dining and other events -- one for food waste, another for recyclables and also

one for composting; (4) nightly assessment of the quantity of food being sent out of the kitchen, the amount being served, and ultimately the amount sent out as waste. The purpose was to determine if the appropriate amount of food is being served; and (5) monthly dining staff meetings and new employee orientations now include a focus on the composting program (EPA, 2007).

While the composting operation focuses on pre-consumer food waste, a strainer system collects the post-consumer food waste for eventual distribution to a local pig farmer. The pre-consumer food waste is taken to a farm in Lisbon, Maine for composting. The school sends approximately 5,200 pounds of coffee grounds, 211,600 pounds of fruit/vegetable peelings, and 1,200 pounds of eggshells per year to the farm (EPA, 2007). The college pays the farm approximately \$2,000 per year to compost the materials. The cost includes gasoline for transporting the materials and also a penny per pound fee for composting.

Materials used in the overall program include a slotted four- inch pan strainer, compost bins for shipping wastes to the farm, a strainer system for the station where post-consumer food waste is removed from the dishes, bins to collect food waste for the farmer, containers for recycling, communication tools and specific-sized serving utensils.

During the 2008-2009 school year Bates College increased the reach of its efforts of its dining program -- the ‘Nourishing Body and Mind: Bates Contemplates Food Initiative’ was born. The purpose of the program was to “explore connections between the dining program, food and the educational mission of the college itself” (Hobart Center, 2014). This increased attention was fueled by the recent unveiling of a new dining commons and also by an anonymous donation of \$2.5 million.



The Food Initiative had two primary goals: Increase understanding across campus with students, staff and faculty about the food system as a whole; and enhance existing efforts focused on sustainability and incorporating the message into the curriculum. According to the Hobart Center for Foodservice Sustainability, the initiative imparted a significant impact on energy and water use, waste reduction, the purchasing of local foods and tying the dining services efforts into the curriculum. The Hobart Center estimates that Bates College saves \$80,000 annually as a direct result of their sustainable dining program. The majority of the savings, \$70,000, is achieved through a dramatic reduction in water costs (Hobart Center, 2014).

Bates College considers their food waste composting program to be a success, as it has brought the school closer to achieving its goal of having truly sustainable operations. In addition, Bates College “has become a model of environmental stewardship, redesigning machinery to conserve both water and energy and diverting a majority of its wastes from the solid waste stream” (Bates College, 2014).

### **5.3 Lafayette College – Easton, Pennsylvania**

Located in the Lehigh Valley in Easton, PA, Lafayette College is a small private liberal arts school with approximately 2,500 students and 200 faculty. The institution boasts that for nearly 200 years “Lafayette has been known for a spirit of exploration that ignores boundaries, where faculty work with students across disciplines to tackle challenges and solve problems” (Lafayette College, 2014). The challenge of reducing food waste is an issue that the school has been testing with a composting program since 2008.

In 2007 Lafayette students began studying ways to more responsibly manage food waste. Students approached Dr. Arthur D. Kney, Associate Professor and Department Head, about

starting a composting program. The initial meetings outlined challenges and hurdles that the group would likely encounter. The group also focused on strategies they believed could get the program running. Conclusions drawn included the need to make academic connections; and create ties to classrooms, research activities, student-driven clubs, and the community (ESRC, 2014). The selling point would be to connect to the overall concept of sustainability.

The first step in the group's plan was to create a composting committee that would include two existing groups on campus: Lafayette Environmental Awareness and Protection (LEAP) and the Society of Environmental Engineers and Scientists (SEES). The new committee created subcommittees to work toward achieving the committee's goals. The group sought support from the faculty and ultimately the school administration. After approval to move forward was given, they collaborated with Dining Services and Campus Maintenance Staff, as they understood their involvement to be critical in establishing a viable program.

Knowing they needed to raise money to begin a pilot project, the committee created 'backyard composting units' for sale. They charged \$100, about one-third the price they found for similar units for sale online. Using the money that was raised the students began making compost on a small scale. Initially the group used a three compartment bin before moving to 42-gallon drums on rollers. Limited capacity was the primary drawback with the initial method. Wanting the program to achieve a far broader impact, the team began seeking external funding sources. The team looked to the Pennsylvania Department of Environmental Protection, the Clinton Global Initiative Grant and private funding sources.

In 2008, a permanent test site was developed to research and investigate feasibility of composting food waste. In 2009, two Earth Tubs were purchased. An Earth Tub is an in-vessel system that holds 3 cubic yards of materials. A 12-inch mixing auger is located in the center of

the tub and is manually turned to mix the materials. The positive attributes are that it is simple, less costly than automated machines and is self-enclosed. The drawback is that it requires manual labor to mix the materials. In 2010, the permanent composting site was built at Bushkill Commons and by summer 2010 the composting process for the Earth Tubs was developed.

In summer 2011 composting at Lafayette was institutionalized. In 2011-2012, research on nitrogen management in compost was conducted. In the summer of 2012, a pilot windrow system was initiated. During fall 2012, internal problems developed, ultimately ending the contract with Sodexo, the food service provider, and temporarily bringing the composting program to a halt.

In fall 2013 Bon Appetit was chosen as Dining Service's preferred partner. This event marks the resumption of the composting program. Students ran the program for two years before passing it on to Plant Operations. In an effort to continue supporting the program, the founding committee of LEAP and SEES began hosting events for K-12 programs and leading various on- and off-campus cleanups (ESRC, 2014).

The composting process at Lafayette includes use of two Earth Tubs developed by Green Mountain Technologies, each with three cubic yards volume. Approximately 50-200 lbs. of food are collected daily, five days per week. On average, it takes about one week to fill a tub. Since the installation of the Earth Tubs over 30,000 lbs. of food waste has been diverted from the landfill (ESRC, 2014).

The collected food waste is pulped, thus increasing surface area of the materials. The waste is then combined with leaves and bulking materials in the proper carbon to nitrogen ratio. Once the tubs are full, the mixture 'bakes' for approximately one week, then cures for at least one month. The finished compost is then used as mulch enrichment for flower beds and around trees and also as a soil amendment for the student-driven organic vegetable gardens. The organic

garden is a two-acre plot that sells produce back to the dining halls, ultimately completing the ‘food loop.’

According to Stacey Dorn, head of compost operations while attending Lafayette as a student, there were many challenges in establishing the composting program. When the food waste was being collected, the dining staff sometimes overfilled containers, making transport cumbersome. Technical issues with lids popping off also became a concern. Once the food waste makes it to the Earth Tubs, it is physically demanding to manually turn the Tub. Additional difficulties included the reliance on unpaid support having to drive to an off-campus composting location. Her advice in addressing these and other challenges is to demonstrate a contagiously enthusiastic attitude and be willing to work through the technical issues that inevitably arise.

Prior to the 2007 program, composting efforts were cyclical, where interest would come and go. According to George Xiques, Head of Plant Operations, reasons for greater success this time around were the following: (1) this was a student-led project; (2) the activity was part of the academic curriculum; and (3) there was enhanced communication between faculty, students and plant operations. As part of the curriculum, the program was able to grow sufficiently large to hand off to the school. The cross-training of students, where juniors and seniors train freshmen and sophomores, has given the program an opportunity to become sustainable. Using the College Sustainability Report Card as the basis for overall assessment, the composting program has continued to improve over time. The following breakdown by year shows the improvement: 2007 D+, 2008 D-, 2009 C, 2010 C+ and 2011 B. The lesson to take from this progress is that establishing a composting program takes planning, commitment, resources and time.

#### **5.4 University of Maine – Orono, Maine**

Located in Orono, Maine, the University of Maine is the state's land grant institution. It has been in operation since 1868. The university has a student population of approximately 11,500, of which roughly 3,600 live on campus. The University has a proud tradition of supporting sustainable programs and promoting the idea of 'completing the circle' when it comes to managing food for on-campus dining. The University operates four food centers on campus, serving approximately 49,750 meals per week (ESRC, 2014). From this total, approximately 7,550 lbs. of pre-consumer food waste is collected weekly. The school does not currently collect post-consumer food waste.

The history of composting on the University of Maine campus dates to the mid-1980s when the University was sending food waste to the University's dairy farm. At the time, the school was using dairy waste for anaerobic digestion to create energy. These activities were relatively short-lived as merely part of a brief research project. In the 1990s, the University transitioned to a turned windrow system located at the University's dairy farm, approximately 1.5 miles from campus. According to Mark Hutchinson, University of Maine Cooperative Extension professor and technical advisor for the school's current composting program, the composting operation was "doomed to failure." This belief stems from that fact that the program had no real 'ownership.' In addition to this critical issue, a permitting problem arose with the state Department of Environmental Protection.

From 2001-2012 the University contracted with an off-campus commercial composting operation. Material was picked up only four days per week, thus creating problems with waste in tubs on loading docks. The commercial composting operation also involved a 50-mile round-trip. This transport of materials meant a larger than desired carbon footprint associated with the

school's composting program. These issues, along with a price tag of \$65,000 per year, meant that the program was not sustainable.

Those on campus involved with composting formed a committee to incorporate stakeholders with different perspectives with the hopes of creating a sustainable program. To promote ownership, they involved Food Services, Facilities, Faculty and Administration. The school initially decided to omit student involvement in an effort to make the program systemic, or part of the 'fabric of the University' before soliciting their participation. The committee needed to determine location, methodology, funding sources and ultimately stakeholder responsibilities. This was a two-year process to get the composting operation up and running.

The composting committee decided on an on-campus location less than 0.5 miles from all food centers, thus reducing transportation costs and to allow for greater access. The selected location is shielded from the community to avoid aesthetic concerns. The location also has the benefit of being adjacent to student gardens, the destination of much of the end-product. The committee decided on an in-vessel system to alleviate concerns of odor and vectors. Funding was provided from an internal source, i.e., Auxiliary Services. Initially, there was a large capital investment from Auxiliary Services of \$400,000. This allowed for the purchase of an 8' x 40' Earth Flow in-vessel system using Green Mountain Technology. Also included in the initial costs was an investment in infrastructure including a road, electricity and site work. A feedstock building to house wood shavings was also built.

The composting process includes collecting food scraps five days per week in 35-gallon plastic bins with plastic bag liners. The program is considering the use of compostable bag liners, but is currently unable to do so, due to the auger technology currently in use. The staff has been trained to load the bins to keep the weight manageable, loading to approximately two-thirds full.

The bins are collected by staff from Resource Recovery. The collected food residuals are then dumped into a three-sided bay which is first amended with horse bedding. The recipe of compost was developed utilizing horse bedding from the campus Equine Center, food waste and occasionally wood shavings. The University uses a 2.5 parts carbon to 1 part food waste ratio. Horse bedding is delivered weekly or biweekly and stored in a feedstock building on-site. This is pre-mixed, then loaded into the in-vessel system. The auger moves left to right and front to back. When depositing 2-3 cubic yards of material per day, the vessel is filled in about 18 to 20 days. The material has a 21-day retention time before being moved to a curing pad for 3-6 months.

After curing, the end-product is primarily used as a soil amendment for a project started in 2012, the Maine Greens Enterprise. In this enterprise, the garden produces approximately 40 pounds of greens per week at a value of \$200-\$240. The greens are then sold to the University's Student Union, Bear's Den, where it accounts for approximately 20-25% of the greens purchased. The end-product is also used at the Rogers Farm Ornamental Horticulture Research facility and the Witter Farm Livestock Research facility. Campus landscape projects consume any remaining compost for use as a soil amendment.

As mentioned above, the initial cost to set up the current operation was about \$400,000. Prior to establishing the new program the University was spending \$65,000 per year on its composting contract. The University accrues savings in approximately \$12,000 per year in waste disposal tipping fees as a result of the composting program. Approximately four hours per day is required to manage the system. Part-time paid student workers collect food waste through the Resource Recovery office.

Looking beyond the financial details, the school receives educational benefits from the compost program. Challenges have also arisen during the project; for example, mechanical issues

arise with mechanical systems – a private Hazmat contractor removed ammonia from the vessel due to chain breakage. Training staff is a challenge when there is high turnover. Other practical issues include managing the ebb and flow of materials, as Monday collections are the largest with no weekend pickup. In addition, school breaks disrupt collection continuity. As a back-up, if the current in-vessel system reaches capacity, the University has a turned windrow system to handle overflow. The University plans to purchase a second in-vessel system to create additional capacity.

Program recommendations from Mark Hutchinson include empowering the staff in conducting the project, and make the process as simple and systemic as possible. Moving forward, the University wants to encourage more student research, begin collecting post-consumer waste and also compost waste from large special events such as the President's Welcome, athletic events and commencement.

## **5.5 Ithaca College – Ithaca, New York**

Ithaca College is a private institution located in Ithaca, New York with approximately 6,500 students, of which approximately 3,800 live on campus. The school has a liberal arts core but also offers professional programs. The Ithaca College Resource and Environmental Management Program (REMP) is responsible for promotion and implementation of programs aimed at sustainability. REMP is funded and coordinated by the Facility Services Department (REMP, 2014). Student representatives and volunteers from the Ithaca College community are responsible for facilitating REMP. The program was originally formed in 1991 from student interest in campus recycling. It now manages composting, energy conservation and resource reduction for the school. Beyond promoting awareness of environmental issues throughout the



college community, REMP aims to “manage the College's waste stream in a cost-effective and environmentally sound manner” (REMP, 2014).

REMP began composting food waste at Ithaca College in January 1993. Initially, the composting program utilized an aerated static pile system in a 40 ft. by 80 ft. steel building located on campus. To accomplish aeration, they modified building fans and connected them to perforated, corrugated, flexible drainpipes. The pipes were placed beneath layers of wood chips and food waste. The aeration fans were computer-controlled to run at specific time intervals or if the temperature in the compost pile exceeded 150° F.

The compost mix was a combination of organic waste and purchased wood chips. The organic waste consisted of approximately 3,000 pounds of food waste per day from the three dining halls. The components were mixed until achieving an approximately 50% moisture content. Using a skid loader with a 5/8-cubic yard bucket, the compost mix was layered onto a roughly 12-inch thick base of wood chips. After five weeks the mixture was screened to collect reusable wood chips that could be added to the next pile of organic waste. The five-week mixture is then transferred outside to a windrow to mature.

After significant experimentation with compost to soil ratios for seed germination both for transplants and field testing, a mixture of 1/3 compost to 2/3 topsoil was decided upon for ornamental planting beds located on Ithaca’s campus and as topdressing to lawns. Using a side-by-side comparison, compost as a soil amendment proved more effective in planting beds than did the use of chemical fertilizers. This effort convinced decision-makers to utilize the finished compost in this capacity.

The program was instituted as a solid waste management strategy with the intent of reducing costs of landfilling. Initially, Ithaca budgeted \$120,000 for the composting operation

infrastructure. They purchased a mixer, vibrating screen, pre-cast concrete walls, fans with monitoring equipment and a skid-loader. In 2000, Ithaca received grant money from the Empire State Development's Recycling Initiative to help offset the initial costs. The College saves approximately \$11,250 each year in tipping fees, based on \$60/ton costs.

Beginning in 2007, Ithaca College began sending its dining hall organic waste to Cayuga Compost, located in Trumansburg, New York. The decision to transition from an on-campus composting operation to a nearby commercial composting operation was made to accommodate an increase in use of compostable disposables (Ithaca College, 2015). To be accepted by Cayuga Compost, bins must have a contamination rate of 5% or less. REMP works to educate the campus community about proper waste sorting. Students in dining halls have the option of placing their waste into one of three bins: (1) compost; (2) landfill; or (3) recycle. The school utilizes a 'trash cop' at times to assist students in making the proper decisions with waste disposal.

The food waste collection process is the same as previously. The school collects all food scraps, including plate scrapings in 'food-only containers' that are located at food preparation and dishwashing areas. Once containers are full, they are transferred to the trash collection areas at dining hall loading docks. The containers are collected Monday through Friday each week. Materials are sent to Cayuga Compost. Wastes generated on Saturdays are sent to the landfill. Sunday-generated wastes are included with Monday's pick-up.

Via both the initial on-campus operation, and with the current arrangement with Cayuga Compost, Ithaca College has demonstrated a commitment to sustainable methods of managing food waste from its campus dining operations.

## **6.0 A COMPOST OPERATION AT BALL STATE UNIVERSITY - RECOMMENDATIONS**

Based on the review of composting methods, the five case studies of colleges and universities composting food waste, the Woodworth Commons waste assessment and the key informant interviews, the following section is presented as a set of recommendations for BSU to consider in developing, implementing and ultimately sustaining a composting program using food waste from BSU Dining Services. Factors to consider when developing the composting operation are explored below.

### **6.1 Stakeholders**

The first step in developing an operation that composts food wastes from campus dining areas is to identify a broad range of stakeholders that may have interest in actively participating in program development and implementation. Generally speaking, that list includes various departments from the University, campus committees, the student body and, potentially local commercial composting companies. After identifying stakeholders, it is recommended that a committee focused solely on composting food waste be formed. Problems or issues that arise can later be addressed with the establishment of subcommittees focusing on more narrowly-defined goals.

Those departments which are absolutely necessary for a successful compost program include Dining Services and Facilities Management. Dining Services would be responsible for collecting the food waste while Facilities Management will be tasked with transporting the food waste and operating the composting site. Other departments mentioned in the interviews that should be considered include Business Affairs and Food Management. An assessment of existing committees is recommended to determine which, if any, may have interest and/or ability to

contribute meaningfully to the composting endeavor. The Council on the Environment (COTE) could potentially be included.

Student involvement in the new program is critical, as it will help provide the requisite passion for program success. This list should include existing student groups. The Ball State Energy Action Team (BEAT) is a student-led group that focuses on “increasing awareness of energy use on campus and creating energy reduction initiatives.” The Ball State Natural Resources Club focuses on raising “environmental awareness and the concern of students for the preservation and conservation of the natural world through service projects, speakers, and activities.” Student involvement should also occur through classes that have a sustainability component.

Local commercial composting companies should be considered in the new initiative, as they bring a wealth of expertise to the table, along with the inclusion of an outsourcing option. It should be determined whether it is more feasible for Dining Services to perform food waste collection and have it picked up and composted off-site by the composting company. This is dependent upon the presence of a company capable of handling the volume of food wastes from a university the size of Ball State. According to the interviews, there are no companies currently in the area that fit this description.

Engaging the administration, faculty, student body, staff and local community have proved to be the most successful approach in establishing a University-wide composting program. Weaving the program into the fabric of the University offers optimal chances for success, rather than merely making it the responsibility of a single department on campus. Integrating the composting experience into the curriculum increases the probability of continuing the program, in addition to providing a more meaningful experience for faculty and students.

Actively involving students, especially having trained upper classmen cross-train lower classmen, proves to be an important strategy to continue and enhance composting programs.

## **6.2 Scope**

It is recommended that a Ball State program focus on composting pre-consumer food waste only. This will eliminate the more difficult materials to compost (e.g., meats, fats, oils), while reducing odors and potential vectors. It is not recommended to utilize post-consumer food waste in the composting operation; however, consideration should be given to locating local farmers capable of taking this food waste to feed to livestock. This offers an otherwise wasted resource as feed for animals while also reducing the amount of waste that is being disposed via traditional avenues.

A pilot project is an essential means of starting the campus-wide program -- this will allow the University to quickly and inexpensively test feasibility of on-campus composting. A trial run will allow the opportunity to identify logistical constraints and propose and test solutions. Amy Grasso, Unit Manager of Woodworth Complex, expressed willingness to allow Woodworth Commons to serve as the location for the trial run. Woodworth Commons has already participated in an initial waste assessment through the collection of data for pre-consumer food waste during Spring semester 2014 (see section 4).

Woodworth Commons is also currently piloting the coffee grounds to compost initiative. Woodworth Commons distributes more food than any other dining area on campus, thus providing a logical starting location. The other 13 food distribution areas on campus should conduct an initial waste assessment to allow for the proper planning of program expansion.

### **6.3 Operation**

The operation of a Ball State University composting program will be directed in large part based on the specific method chosen. As detailed in Section 4, vermicomposting, turned windrows, forced aerated stated pile and in-vessel systems have similar, yet different operating needs. It is recommended that Ball State University utilize either a forced aeration or turned windrow system. The forced aerated system can be constructed by the University at relatively low cost. Vermicomposting is not recommended, as the scale of the operation necessary to handle the volume of food waste from the dining halls is not practical. An in-vessel system is not recommended due to the high initial and operating costs involved. Windrows will be needed for curing the piles.

It is important to estimate potential volume of the finished compost, so that a plan is established regarding how to store, apply and distribute the material. It is envisioned that the finished compost be applied to BSU grounds. If the University plans to distribute the finished compost, testing will need to occur to ensure hygienic safety. If acceptable, the finished compost can be sold or used in a University student garden.

#### **6.3.1 Siting**

According to the Key Informant Interviews, the Ball State Heath Farm is the only existing campus location capable of handling the quantity of food waste that is produced from campus dining. If another location becomes available, siting characteristics must be considered. This includes access to roads and feedstocks. The protection of water quality, specifically leachate management, is a critical factor to consider. Neighboring properties must also be addressed in siting. The effects from odor, noise, dust, debris, vectors, and ultimately aesthetics will play a major role in the sustainability of the operation.

### **6.3.2 Variables**

As mentioned in the Introduction, properly mixing the feedstock, including food waste, carbon source and bulking agent, is vital for the success of a composting operation. Attaining the suggested carbon to nitrogen ratio will allow indigenous microbial communities to rapidly decompose the mix. Providing the appropriate particle size will allow optimal surface area needed by microbial communities while avoiding compaction. The supply of food waste will not be a concern. The purchase of a shredder for the feedstock is recommended. Wood chips can be obtained on-campus, as cut timber is currently being chipped at the Heath Farm.

Monitoring of moisture content, oxygen concentrations and temperature will ensure that the compost piles operate efficiently while mitigating potential concerns of leachate generation, odors, vectors, pathogens and bioaerosols.

### **6.3.3 Permitting**

The Indiana Department of Environmental Management (IDEM) Office of Land Quality (OLQ) is the key state entity which would provide the permit for a proposed Ball State composting operation. As of February 2015, there is no specific statute designated for composting food waste as there is for composting yard waste. IC 13-20-10 outlines requirements regarding the registration, siting, design and operational requirements of yard waste composting facilities. Per IDEM OLQ, the agency is in the early stages of drafting a rule that will specifically address composting food waste. For the present, composting food waste is currently covered under IAC 6.1 Section 5 – Marketing and Distribution Permit of waste products. This regulation focuses on quality of the finished compost. Quality is assessed via analytical testing of the finished compost and subsequent reporting to IDEM OLQ.

Compost producers are required to provide education to the end-user regarding how to correctly apply the finished compost. If food waste generated and composted on-site, and the finished compost is applied on-site, then a Commissioner's Approval is possible, and the operator is not required to obtain a permit. This exception does not exempt the operator from future regulatory requirements, however. Considering the fluid nature for which composting food wastes is being regulated in the state of Indiana, it is recommended that Ball State University reach out to IDEM OLQ during the planning process. The recommended contact is listed below.

Jeff Harmon

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## **Appendix A**

### **Woodworth Commons Data**

**Food Scrap Totals – Woodworth Commons**

Date	Total (lbs.)
Monday, 2/10/2014	67
Tuesday, 2/11/2014	32
Wednesday, 2/12/2014	98
Thursday, 2/13/2014	82
Friday, 2/14/2014	120
Saturday, 2/15/2014	61.5
Sunday, 2/16/2014	61
Monday, 2/17/2014	67.5
Tuesday, 2/18/2014	65.5
Wednesday, 2/19/2014	85.5
Thursday, 2/20/2014	106
Friday, 2/21/2014	62.5
Saturday, 2/22/2014	82
Sunday, 2/23/2014	45
Monday, 2/24/2014	87
Tuesday, 2/25/2014	86
Wednesday, 2/26/2014	66
Thursday, 2/27/2014	107.75
Friday, 2/28/2014	92
Saturday, 3/1/2014	50
Sunday, 3/2/2014	93
Monday, 3/3/3014	51
Tuesday, 3/4/2014	112.5
Wednesday, 3/5/2014	87.5
Thursday, 3/6/2014	62
Total	1,920.25
Average Daily Weight	77.21
High Daily Weight	120
Low Daily Weight	32

### Daily Log of Dining Food Scraps – Woodworth

Date 2/10/14

# 67

### Daily Log of Dining Food Scraps – Woodworth

Date 2/11/14

32 #

Daily Log of Dining Food Scraps -- Woodmont

Date 2/12/14

12#
11#
32#
10#
25#
2#
6#

98



Daily Log of Dining Food Scraps - Wednesday

Date 2/13/14

36#	Am
9#	
12#	Pm
4#	
3#	
3#	
8#	
2 1/2#	
3 1/2#	

82

5

**Date.**

2/14/14

23<sup>#</sup>

28#

11 址

14#

5 #

Q#

5#

23#

120

## Daily Log of Dining Food Scraps – Woodbury

Date 2/15/14

18#

	1	lbs
--	---	-----

5 1/2 lbs

13 12s

2/168

12 lbs

61.5

**Date**

5#

16#

5#

5#

5.25#

10 #

12 #

2.75#

61

Date 2/17/14

Date 2/17/14

67.5

Daily Log of Dining Food Scraps – Woodworth

Date 2/18/14

13 #
17 #
10 #
= 40 #
6 #
5 #
4 #
5 #
5½ #
= 25.5
= 65.5

Date,

**Sergeant Woodworth**

Date,

2/19/14

5<sup>#</sup>  
5 1/2

11#

6

21 共

8#

14#

9#

6th

5#

85.5

Daily Log of Dining Food Scraps - Woodmont

Date 2/20/14

48#
14#
15#
12#
2#
2#
13#

106



**Date**

2/21	14
------	----

9#  
3#  
10 1/2#  
7#  
~~3#~~ 9#  
9#  
5#  
10#

62.5

Daily Log of Dining Food Scraps - Woodward

Date 2/22/14

45# LB
11#
8 1/2#
14 1/2#
2#
1#

82

Date 2-23-14

10\*

19#

3 1/2#

12 1/2

45

## Daily Log of Dining Food Scraps - Woodworth

Date 2/24/14

25<sup>th</sup>

16#

7 1/2 #

8 1/2 #

13 #

17#

8

## Daily Log of Dining Food Scraps – Woodworth

Date 2/25/14

14#

24#

6#

6#

6#

20#

10#

86

## Daily Log of Dining Food Scraps – Woodworth

Date 2/26/14

11#  
6#  
10#  
9#  
7#  
4#  
10 1/2#  
8 1/2#

66

Daily Log of Dining Food Scraps - Woodworth

Date 2/27/14

10 #
13 #
6 #
24 #
20 #
5 #
<del>3 #</del> 5 #
<del>2 #</del> 3 #
3 1/2 #
5 #
13 #
1/4 #

107.75

### Daily Log of Dining Food Scraps – Woodward

Date 2/28/14

[illegible]

92





## Daily Log of Pining Food Scraps - Woodward

Date 3/2/14

[illegible]

93

### Daily Log of Dining Food Scraps - Woodward

Date 3/3/14

[illegible]

51

Daily Log of Dining Food Scraps – Woodworth

Date 3/4/14

46 #
24 #
10 1/2 #
9 #
7 #
7 1/2 #
8 #
1 1/2 #

112.5

Wed. Date 3/5/14

Date 3/5/14

[illegible]

87.5

Date 3/6/14

Date 3/6/14

12#  
15#  
6#  
3#  
4#  
20# per Chef.  
2#

## **Appendix B**

### **Key Informant Interviews**

## **Interview Transcript**

**Interviewer:** Michael Ellis

**Interviewee:** Jon Lewis – Director of Campus Dining Services

**Interview Location:** Carmichael Hall, Ball State University

**Interview Date and Time:** February 4, 2015 – 10:00 AM

*(Start of Interview)*

**Interviewer: How long have you been in your current position as Director of Campus Dining Services? Please also tell your position's responsibilities.**

Interviewee: 9 years, 1 month and 4 days. It's easy when you start on January 1<sup>st</sup>. The responsibilities, we have 14 dining operations including catering, and sports operations. And we are responsible for all the service, the quality, the purchasing of the food, the serving of the food. And the financial aspect as well, employing over 1,000 full-time, part-time and student employees. Everything that goes into running a restaurant, we do.

**Interviewer: What is your opinion of Ball State developing a composting program using pre-consumer and/or post-consumer food scraps from campus dining halls?**

Interviewee: Well, I think it would be a noble endeavor, but Dining can't do it on its own. It has to be a collaboration with Facilities Management, Grounds, a lot of people, a lot of departments on campus. And quite frankly, I am not sure the campus is ready to put the resources into what it would take to do that. Currently, we work with a local farmer who picks up pre-consumer waste. It is my understanding that composting either pre-consumer or post-consumer waste with a lot of animal protein in it is much more challenging than vegetable, fruit and even paper scraps. To develop the program the way it has to be developed, to have the financial resources to do it, I am



not sure the University is ready to do that. Having said that, if there is a local business who is willing to pick up our scraps, we'd be ready to collect them, but we haven't found anybody like that. There are a few companies in the area I understand that do it, but they won't talk to us, they probably have their hands full. And the other piece of it that is kind of difficult, is when you are collecting compostable scraps, collecting recyclable materials, you need a place to store it. A lot of our facilities just don't have the square footage to both store it and have a dumpster outside, have some place to put them, waiting for someone to pick up. Most of these companies that pick up compostables, don't do it every day. They pick it up once a week, once a month. You have to have a place to store the stuff. And then you have to manage the other effects, the smells, the rodents, everything that goes along with that. Is it a noble endeavor? Absolutely. I just don't know when the University will be ready to take that.

Have you gone to, the Ohio University website, and looked at their in-vessel composter?

You should go to the Ohio University website, there is quite a good description. The challenges, they had building. They built a pole building for this device. The device itself is half a million dollars. And then you have to have a full-time employee. A truck that does nothing but truck the compostable material to it, load it, unload it when it's done. Then put it into rows. In Ohio you have to have it tested for pH and other things, before they can sell it. So their whole goal was to maybe sell compost, and pay for the program. It doesn't happen. And beyond that, this in-vessel, which is over a half a million dollars, plus an employee, handles one building. So it's nice to say you do it, but is it really that effective.

**Interviewer: You spoke to the different departments that you believe should be involved with the program, is that the entire list? Are there any other departments that need to be involved to make this program practical, and sustainable?**

Interviewee: Well I think COE, Council on the Environment, would want to be involved a little bit. There are a lot of sustainable academic components, in many different classes, you would see a good interest from the academic side. Food Management would want to be involved, Dining. Facilities Management would have to be involved, they would have to be one of the major players. And remember we are composting coffee grinds, which are very easy to compost.

**Interviewer: Again, you spoke to what groups would be involved. What kind of support do you think there would be across campus?**

Interviewee: I think everybody would say it's a good idea. But who is going to do it, who is going to pay for it? Not out of my budget is what people would say. Unless something magical happens. Now if the President said we are going to do this, find the money, find the resources, to whatever level he said you are going to do something, then it would happen. It's not, it's one of those odd things. Everyone says let's plant a campus garden, no they say you plant the campus garden, wouldn't that be great. So we are going to do another one this summer. It's easy to say you folks do it. That's just the way a university works.

**Interviewer: What advice would you give for the collection of pre-consumer and/or post-consumer food scraps from campus dining halls?**

Interviewee: Volume and weight is an issue. You're dealing with employees, you got to be careful about injury when it comes to this stuff. For our farmer, we settled on 10-gallon Rubbermaid trashcans, that we put on dollies. That weighs about 80 lbs. when you're done. Because it's on a dolly, he can easily shift into his truck off the dock. So we would just expand on that. The place to start would be pre-consumer. Post-consumer, a lot more difficult. The vessel you would use to collect it, putting on the consumer to properly sort the items. So at Ohio University, the way they handled that, was everything that goes in the trash can is compostable.

The plate, the napkin, the plastic flatware, the corn flatware. Everything that went in the trash can is compostable. You don't have to worry about separation for the most part, until the kid throws an aluminum can in there. But that gets sorted through. So if you are in an environment that has plastics and paper that isn't compostable, and other stuff, and then you have a customer try to separate the post-consumer waste, it's not going to be pretty. So I would start with pre-consumer where you got an employee that can separate. Maybe they don't put meat scraps in, we just start with fruits and vegetables, that kind of thing on one hand. On the other hand, we are going to more and more pre-cut, pre-cleaned, fruits and vegetables and other products. So we let Indy Fruit & Vegetable clean it for us, and they compost the rinds and wastes from the fruit. So were doing more and more of that, you might see us have less and less pre-consumer. Plus anymore, Muncie will not let us put any of that refuse down the garbage disposal, down the sewer system. It has to go to the dumpster in solid form. So we are trying to avoid as much as we can. It's not easy for an employee to do that, to separate into a plastic-lined box and lift into a dumpster.

**Interviewer: What do you believe will be the most effective means of education the student body on a composting program?**

Interviewee: Well we have a marketing coordinator, she is really good at that stuff. We would use the student newspaper, use our website. We would use onsite events to help train. We would be at the trash can, we do that all the time with various programs. We would turn it over to our marketing coordinator, let her do the selling to the students as much as she could. Of course it's difficult because you got a new set of freshman class. It's not something you do once, you do all the time.

**Interviewer: What role would you want to have if a composting program were to be developed and implemented? Would you want a leadership role considering your position?**

Interviewee: Oh, I think so. It has to be collaborative, so we would have to have a committee. I would assign one of my other people to it. Most likely, someone who has a passion for it, can spend time on it. Our marketing communicator would be a good person to do it. But again, it has to be a campus wide group that gets together once a month, once every two months or so and talks about it. We do that now with BEET, the student group that does energy education on campus. We are already used to doing that.

**Interviewer: You have already touched on several, what other obstacles to the program can you foresee? Any ideas to overcome obstacles?**

Interviewee: It's a resource issue. If the university has a passion for doing it, you can do it, you can do it in increments. Start in one place, as we do with coffee grounds, scale up from there. Again, it's just the matter of the University being committed to it. I would love it there was some company out there, in Muncie, that would take this on as for-profit endeavor. It is a difficult item. It would be great to have the private sector in it, rather than the University necessarily on its own. Someday someone will be able to figure out how to make money off of it. It will be something that takes off. But until it gets to that point, it's going to be a little iffy. That would be our best scenario. There is a company in Fishers, in Carmel that does it. Indy Fruit and Vegetable gives their trimmings to this company. They may even get paid for it, I am sure not much. So there is someone in this area doing it, I suspect the volume, how much they want to take on. In turn, the reverse how much can they sell. If they can't make money on it. You can't do it. So that's my hope.

**Interviewer: Is there anything important you think was missed from this discussion that should be addressed?**

Interviewee: I think you are all set.

**Interviewer: Thank you**

## **Interview Transcript**

**Interviewer:** Michael Ellis

**Interviewee:** Amy Grasso – Woodworth Complex Unit Manager

**Interview Location:** Woodworth Commons, Ball State University

**Interview Date and Time:** February 4, 2015 – 11:00 AM

*(Start of Interview)*

**Interviewer: How long have you been in your current position as Woodworth Complex Unit Manager? Please also tell your positions responsibilities.**

Interviewee: I have been in the manager's position here at Woodworth since 2004. So 10 years, and I oversee the entire unit. I am responsible for the budget, all the sales, all the purchases, all the employees, staff, management, everything.

**Interviewer: What is your opinion of Ball State developing a composting program using pre-consumer and/or post-consumer food scraps from campus dining halls?**

Interviewee: We do have a lot of vegetable scraps that we currently are just throwing out, that we could definitely could put into compost. We currently are using coffee grounds with the filters they pick up every week. I think it would be great thing to move on to the next step and take on the cut portions we are not using in the front of house to serve. As far as the post-consumer food scraps. A lot of the products when they come back to the dish room have sauces on them. I don't really think it would be feasible for us to try and sort that. Busy days, on very heavy days, we'll put through 6,000 transactions a day. And there has to come a time when what is feasible to do with staff and what's not. We are having a difficult time just recycling, on what comes through the tray line. When you have tray after tray after tray during rushes we just can't

keep up. So to deal with the post-scrap would be difficult for us. If we were a smaller facility that didn't have quite the numbers, it might be easier to sort that type of thing.

**Interviewer: You mentioned coffee grounds, where do they go for composting?**

Interviewee: They go out to Facilities Management, on campus. We have a green trash can we keep out on the dock. Every day or throughout the day, they have a bucket in each area where we have our coffee machines. We have two different locations in the unit, they'll go dump those in every day. And once a week they will pick those up and go dump in the compost and bring the container back.

**Interviewer: How do you believe the program would be received across campus, from administration to students?**

Interviewee: I think the students and the staff on campus would like to know that we are utilizing and trying to save the environment and put less into the landfills. I think it's a positive movement, an area our department I know has been taking a look at. Anything that we can do, we can change in our process to better the environment, you know we certainly have been looking at. Its getting facilities on board, I think, we have to bridge that gap, possibly.

**Interviewer: What campus departments do you believe should be involved with the program, from formation of an initial committee to the actual implementation? Why?**

Interviewee: I know there is a Committees on Campus that deals with recycling and things like that. I am not sure what the names are. I know there are areas on campus, where we are, looking at recycling and what other departments are doing, I am not sure of the name. Jon Lewis may know. Definitely, that committee would be great to be in the know of what the planning is, and what we are doing. Business Affairs Department who we report to, I know they would like to know. For energy, I don't know the name of the different committees. They are always trying to

find ways to report to the state how we are cutting back, or being more energy efficient, things like that. But definitely Facilities, Dining, we could definitely get a working relationship on that. Because we already have that going for the coffee grounds. I know on their end that is a lot more to manage than us, all we would do is throw it in a bin and send it their way. They got to be able to move the pile, mix the pile, rotate it. That might be what they are looking at know if they have the man power to be able to maintain that on their end. That would be something that I think they would have to work out.

**Interviewer: What advice would you give for the collection of pre-consumer and/or post-consumer food scraps from campus dining halls?**

Interviewee: We would outline with the staff our expectations of what they will do. I know back when we measured the weights. We gave them the directions, they weighed everything, documented it. If we continue to do that so we know how many pounds are going to the landfill, or to the compost pile. We would certainly get a different color bin for the dock. So that they would dump their food scraps into that. It might be an orange bin, a yellow bin, something like that would be different from the coffee ground or we combine it with the coffee grounds, its going to the same place. We would definitely get a couple of bins on the dock and we would have to have a routine pick-up. Once a day. Probably at least once a day minimum. We wouldn't be able to store a lot of them on the dock because we would probably fill up a huge trash can container, a 60 gallon. Then you get to the point of moving those containers, handling those containers, to getting them out there. They would probably have to move them on dollies. You know, so there is a lot more manpower coming around to pick those up. But they do pick-up the wooden skids off our dock, a couple times a week. So they are routinely making rounds



to our docks, dock areas and picking up the coffee grounds now once a week. So we would have to incorporate a daily, set schedule when they would come by and pick that up.

**Interviewer: What do you believe will be the most effective means of education the student body on a composting program?**

Interviewee: Social media. Dining has a Facebook, Twitter page. Of course they have to like our page, or follow us in order to be in the know. But social media is the best way. That is the way the new generation works. Emails, no. We send out emails to student employees and a lot time they roll right past them instead of reading them. Just the day and age, but if its out there on social media they'll look at it.

**Interviewer: What potential obstacles to the program can you foresee? Any ideas to overcome obstacles?**

Interviewee: I think getting the Facilities Department to buy in to it, but I don't know on their end. With veg prep, I don't know if seeds can go in a compost pile or not, you know what I mean. So there would be some things like that we would have to get information on so that we are sending them exactly what they want. I certainly do not want to send something that's going to make it a nightmare for them. I don't want tomatoes growing in the mulch on campus because we send something to them with seeds. I don't know, but that could be a challenge to separate all of that. Like I mentioned in the dish room anything with post-consumer we would try to sort would be challenging for us on that end. Just because the amount of numbers and customers that we go through.

**Interviewer: A lot of those materials are more difficult to compost anyways**

Interviewee: A lot of the salads that come back have dressings on them, well then it has milk product if its ranch dressing, you know what I mean? And so that can play a role in the growth of the compost. So that would be a challenge I think on that end.

**Interviewer: It appears there is a sufficient amount of pre-consumer food scraps that would suffice.**

Interviewee: Yeah, pre-consumer. I remember the weights were pretty big, that we were turning into you.

**Interviewer: In one month, I totaled the numbers yesterday, was actually about a ton. About 2,000 pounds in a month. Multiplied by all the different residence halls.**

Interviewee: Now our waste, not our waste, but the left-over food we have, we don't feel would be excellent quality for us to reheat for our customers, we do donate to the Muncie Mission and the Harvest Soup Kitchen. They come every Monday, Wednesday, Friday and pick up anything we have. Anything that may be getting close on date, quality is just not right, but is still edible. I am certainly not going to charge anything full-price. I do not want to put out items that do not look off good quality at half-price. We do not believe it that, with our expectations. So we are doing a lot on that end, helping out the community. So not everything is going in the trash can.

**Interviewer: What role would you want to have if a composting program were to be developed and implemented?**

Interviewee: I would definitely like to maybe do a trial run. I would be willing to let Woodworth be the trial run for Facilities if they buy into and are interested. You know, I would love to do that. We are the largest producing kitchen on campus for food items, because we are one of the busiest. So as far as food scraps and that sort of thing, we may have a lot more than what the other units would. I would definitely be on board to see how it would work.

**Interviewer: Is there anything important you think was missed from this discussion that should be addressed?**

Interviewee: No

**Interviewer: Thank you**

## **Interview Transcript**

**Interviewer:** Michael Ellis

**Interviewee:** Mike Planton – Associate Director of Landscape and Environmental Management

**Interview Location:** N/A – via email

**Interview Date and Time:** February 4, 2015

*(Start of Interview)*

**Interviewer:** How long have you been in your current position as Director of Campus Dining Services? Please also tell your positions responsibilities.

Interviewee: 22 years. Responsibilities include all landscape installation & maintenance on campus; campus wide pest control; campus trash & recycling; campus storm water management.

**Interviewer:** What is your opinion of BSU developing a composting program using pre-consumer and/or post-consumer food scraps from campus dining halls?

Interviewee: BSU has had a composting operation for 25 years. The inclusion of food wastes in the BSU composting would require applying for and being approved for a new permit from IDEM. It would require more equipment and manpower in Landscape Services and Dining to handle the waste stream. The decision to implement this would require a detailed cost / benefit analysis. I'm skeptical it can be done with the resources we have.

**Interviewer:** How do you believe the program would be received across campus, from administration to students?

Interviewee: A percentage of campus would think it was great. A percentage of campus could care less. The majority of campus would be somewhere in between. What percentage of the campus community compost at home?

**Interviewer: What campus departments do you believe should be involved with the program, from formation of an initial committee to the actual implementation? Why?**

Interviewee: Don't see the need to have any type of committee. The process would be almost exclusively handled Landscape Services and Dining.

**Interviewer: What campus locations do you believe are viable options for a composting operation?**

Interviewee: The Heath Farm is the only location large enough to handle the volume. Low volume units have been studied for use at Dining docks but were quickly eliminated due to space and the inability to keep up with the perceived volume.

**Interviewer: Is there a particular method (e.g., vermicomposting, in-vessel, forced aerated static pile, turned windrows) that you believe is best suited for the needs of the university?**

Interviewee: In vessel would be the best and most expensive. Turned windrows would be the least expensive but offer more opportunities for problems with run-off, vectors, smell, etc.

**Interviewer: What advice would you give for the collection of pre-consumer and/or post-consumer food scraps from campus dining halls?**

Interviewee: For the permitting process I would need to have a pretty good handle on volume per day. The material collected would need to be fairly clean of non-compostable products ( meats, plastics etc. ).Dining and Landscape Employees would require training on the proper methods of handling the materials. Specific areas of the dining docks would need to be designated to store the shipping containers. Special equipment would need to be purchased to handle the food waste in the compost operation. Again a detailed cost / benefit analysis would need to be done to make sure if the process is worth the long term expenditure and commitment.

As a part of this analysis it needs to be studied if there are ways to reduce the volume of food wastes initially.

**Interviewer: What do you believe will be the most effective means of education the student body on a composting program?**

Interviewee: If the process is to collect pre-consumer waste the answer is none. Post-consumer waste would take quite an extensive training program and quite frankly I don't have much faith in it. The students can barely recycle other items that are less difficult to deal with than food wastes.

**Interviewer: What potential obstacles to the program can you foresee? Any ideas to overcome obstacles?**

Interviewee: As mentioned several times above getting clean food wastes; transportation and handling; permitting; management of the actual site; manpower.

**Interviewer: What role would you want to have if a composting program were to be developed and implemented?**

Interviewee: As a former organic landfill operator I would be in charge of the entire program.

**Interviewer: Is there anything important you think was missed from this discussion that should be addressed?**

Interviewee: "Not at this time."